

PRELIMINARY DRAFT - SUBJECT TO REVISION DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR SWRCB BASE STUDY WITH D-1485 DELTA STANDARDS (ALTERNATIVE 1) 1995C6FSWRCB-467

In addition to meeting D-1485 Delta standards, Base Study 467 meets selected upstream requirements and CVPIA flow criteria.

I. New Model Features

A new DWRSIM version with the following enhancements is employed:

A. A new SWP and CVP south-of-Delta delivery logic uses (i) runoff forecast informatic uncertainty (not perfect foresight), (ii) a delivery versus carryover risk curve and (iii) a standardized rule (Water Supply Index versus Demand Index Curve) to estimate the total available for delivery and carryover storage. The new logic updates delivery levels on January 1 through May 1 as water supply parameters become more certain. Refer to Leaf Arora (1996) for additional information on the new delivery logic.

B. An expanded network schematic includes more details in the Delta and along the DMC SWP-CVP Joint Reach facility.

C. A network representation of the San Joaquin River basin was adapted from USBR's SANJASM model. The San Joaquin River basin schematic was expanded to include (i) the Tuolumne River upstream to Hetch Hetchy and Cherry/Eleanor Reservoirs, (ii) the Merced upstream to Lake McClure, (iii) the Chowchilla and Fresno Rivers upstream to Eastman and Hensley Lakes, respectively, and (iv) the San Joaquin River upstream to Millerton Lake.

D. Contra Costa Water District's "G" model is used to relate Delta flows and salinities to Denton (1993) for additional information on the procedure.

E. References:

Leaf, R.T. and Arora, S.K. (1996). "Annual Delivery Decisions in the Simulation of California State Water Project and Federal Central Valley Project using DWRSIM." Proceedings 1996 North American Water and Environment Congress, ASCE, C.T. Bathala, Ed.

Denton, R.A. (1993). "Accounting for Antecedent Conditions in Seawater Intrusion Modeling - Applications for the San Francisco Bay-Delta." Proceedings 1993 National Conference on Hydraulic Engineering, ASCE, H.W. Shen, Ed.

II. Instream Flow Requirements

A. Trinity River minimum fish flows below Lewiston Dam are maintained at 340 TAF/year all years, based on a May 1991 letter agreement between the USBR and the U.S. Fish and Wildlife Service.

B. Sacramento River navigation control point (NCP) flows are maintained at 5,000 cfs in above normal water years and 4,000 cfs in all other years. This criteria is relaxed to 3,250 cfs when Shasta carryover storage drops below 1.9 MAF and is further relaxed to 3,250 cfs when Shasta carryover storage drops below 1.2 MAF.

C. Feather River fishery flows are maintained per an agreement between DWR and the Cal Dept. of Fish & Game (August 26, 1983). In normal years these minimum flows are 1,700 cfs from October through March and 1,000 cfs from April through September. Lower minimum flows are allowed in low runoff years and when Oroville storage drops below 1.5 MAF. A maximum flow restriction of 2,500 cfs for October and November is maintained per the agreement criteria.

D. Stanislaus River minimum fish flows below New Melones Reservoir range from 98 TAF/y up to 302 TAF/year, according to the interim agreement (dated June 1987) between the U.S. and the Calif. Dept. of Fish & Game. The actual minimum fish flow for each year is based on the water supply available for that year. Additional minimum flow requirements are in place from June through September (15.2 - 17.4 TAF per month) to maintain dissolved oxygen levels in the Stanislaus River. Channel capacity below Goodwin Dam is assumed to be 8,000 cfs. CVP contract demands above Goodwin Dam are met as a function of New Melones Reservoir storage and inflow per an April 26, 1996 letter from USBR to SWRCB.

E. Tuolumne River minimum fishery flows below New Don Pedro Dam are maintained per an agreement between Turlock and Modesto Irrigation Districts, City of San Francisco, Dept. of Fish & Game and others (FERC Agreement 2299). Base flows range from 50 cfs to 300 cfs. Base and pulse flow volumes depend on time of the year and water year type.

F. Instream flow requirements are maintained in accordance with CVPIA criteria (see It at the following locations: below Keswick Dam on the Sacramento River, below Whiskeytown Dam on Clear Creek and below Nimbus Dam on the American River.

III. CVPIA Flow Criteria

The following CVPIA flow criteria are in accordance with an April 26, 1996 letter from USBR to SWRCB:

A. Flow objectives between 3,250 cfs and 5,500 cfs are maintained below Keswick Dam on the Sacramento River. Flow requirements during October through April are triggered by Shasta carryover storage.

B. Flow objectives between 52 cfs and 200 cfs are maintained below Whiskeytown Dam on Clear Creek, depending on month and year type.

C. Flow objectives between 250 cfs and 4,500 cfs are maintained below Nimbus Dam on the American River. Flow requirements during October through February are triggered by Folsom carryover storage. Flow requirements during March through September are triggered by previous month storage plus remaining water year inflows.

IV. Trinity River Imports

Imports from Clair Engle Reservoir to Whiskeytown Reservoir (up to a 3,300 cfs maximum specified according to USBR criteria. Imports vary according to month and previous month Clair Engle storage.

V. Hydrology (HYD-C06F)

A new 1995 level hydrology, HYD-C06F, was developed similar to HYD-C06B described in a June 1994 memorandum report entitled "Summary of Hydrologies at the 1990, 1995, 2000, and 2020 Levels of Development for Use in DWRSIM Planning Studies" published by DWR's Division of Planning. HYD-C06B was based on DWR Bulletin 160-93 land use projections which simulates the 71 year period 1922-92. HYD-C06F, developed through consultation with USBR to address differences in San Joaquin basin hydrology, simulates two additional years (1993 and 1994) and includes the following major modifications compared to HYD-C06B:

A. Stand-alone HEC-3 models of the American, Yuba and Bear River subsystems were updated and extended through 1994. Yuba River minimum fishery flows below Bullards Bar Dam were not modified to reflect new FERC requirements. According to consultants for the Yuba Water Agency, water supply impacts of the new requirements are not substantially different from those modeled in HYD-C06B.

B. Mokelumne River minimum fishery flows below Camanche Dam are modeled in HYD-C06F per an agreement between EBMUD, U.S. Fish and Wildlife Service, and Calif. Dept. of Fish & Game (FERC Agreement 2916). Base flows range from 100 cfs to 325 cfs from October through June, depending on time of the year and water year type. Base flows are maintained at 325 cfs from July through September for all water year types. Water year types are determined by reservoir storage and unimpaired runoff. For the months of April through June, additional

flows are maintained up to 200 cfs depending on water year type and reservoir storage.

C. Historical 1993-94 land use was estimated by linear interpolation between 1990 and normalized projected levels.

VI. Pumping Plant Capacities, Coordinated Operation & Wheeling

A. SWP Banks Pumping Plant average monthly capacity with 4 new pumps is 6,680 cfs (or cfs in some winter months) in accordance with USACE October 31, 1981 Public Notice criteria. Pumping is limited to 3,000 cfs in May and June and 4,600 cfs in July to comply with I criteria for striped bass survival. Additionally, per a January 5, 1987 interim agreement between DWR and the Calif. Department of Fish & Game, SWP pumping is limited to 2,000 cfs in a May or June in which storage withdrawals from Oroville Reservoir are required.

B. CVP Tracy Pumping Plant capacity is 4,600 cfs, but constraints along the Delta Mendocino Canal and at the relift pumps (to O'Neil Forebay) can restrict export capacity as low as 3,000 cfs. Pumping is limited to 3,000 cfs in May and June in accordance with D-1485 criteria for bass survival.

C. CVP/SWP sharing of responsibility for the coordinated operation of the two projects maintained per the Coordinated Operation Agreement. Storage withdrawals for in-basin split 75 percent CVP and 25 percent SWP. Unstored flows for storage and export are split 75 percent CVP and 25 percent SWP.

D. Wheeling of CVP water through SWP facilities to San Luis Reservoir is permitted as to offset the CVP Tracy Pumping Plant's compliance with D-1485 criteria in May and June. SWP pumping capacity is made available so that CVP wheeling is completed in July and August of each year.

E. CVP water is not wheeled to meet Cross Valley Canal demands.

F. Enlarged East Branch aqueduct capacities are assumed from Alamo Powerplant to Devil Canyon Powerplant.

VII. Target Reservoir Storage

A. Shasta Reservoir carryover storage is maintained at or above 1.9 MAF in all normal years for winter-run salmon protection per the NMFS biological opinion. However, in critical years following critical years, storage is allowed to fall below 1.9 MAF to 1.2 MAF (as in extremely dry years).

B. Folsom Reservoir storage capacity was reduced from 1010 TAF down to 975 TAF due to sediment accumulation as calculated from a 1992 reservoir capacity survey.

C. Folsom flood control criteria are in accordance with the December 1993 USACE report "Folsom Dam And Lake Operation Evaluation". This criteria uses available storage in the reservoirs such that the maximum flood control reservation varies from 400 TAF to 670 TAF.

VIII. SWP Demands, Deliveries & Deficiencies

A. Deficiencies are imposed as needed per Monterey Agreement criteria and are calculated the following 1996 Table A entitlements assuming zero entitlements and deliveries to San Barbara and San Luis Obispo Counties through the Coastal Aqueduct:

Agricultural Entitlements	1,175 TAF/year
M & I Entitlements	2,869
Recreation & Losses	64
Total Entitlements	4,108 TAF/year

B. Maximum SWP Contractor deliveries are designed to vary in response to local wetness indexes. As such, maximum deliveries are reduced in the wetter years, assuming greater availability of local water supplies.

1. Deliveries to San Joaquin Valley agricultural contractors are reduced in wetter years using the following index developed from annual Kern River inflows to Lake Isabel

	Dry/Avg.	Above	Wet	
Kern River flow (TAF/year)		<1,000	1,000-1,400	>1,400
Max. Ag delivery (TAF)	1,175		1,100	915

2. Deliveries to Metropolitan Water District of Southern California are reduced i years using the 10-station, two-year average precipitation index:

	Dry	Avg.	Above	Wet	
S. Calif. Precipitation (in/yr)		<15	15-17.9	18-20.9	>20.9
Max. MWDSC delivery (TAF)	1,433		1,183	883	783

3. Maximum deliveries to all other SWP M&I Contractors are NOT adjusted for a wetness index, and are set at 857 TAF/year in all years. As a result of the use wetness indexes, the total maximum delivery to all SWP Contractors varies by year ranging between 3,529 TAF in the dry-average years down to 2,619 TAF in the wet years, as follows:

	Dry/Avg.	Avg.	Above	Wet	
Max. Ag delivery	1,175		1,175	1,100	915
Max. MWDSC delivery	1,433		1,183	883	783
Max. Other M&I delivery	857		857	857	857
Fixed Losses & Recreation		64	64	64	64
Total Maximum SWP Delivery	3,529			(total varies)	

A range of maximum SWP deliveries is possible as the two wetness indexes are independent each other. Thus a given year may be classified as "average" for agricultural delivery Kern River flow index, and at the same time be classified as "above average" or "wet" MWDSC deliveries by the Southern California precipitation index.

C. When available, "interruptible" water is delivered to SWP south-of-Delta contractor accordance with the following assumptions based on the Monterey Amendment White Paper redraft dated September 28, 1995:

1. Interruptible water results from direct diversions from Banks Pumping Plant. stored in San Luis Reservoir for later delivery to contractors.
2. A contractor may accept interruptible water in addition to its monthly scheduled entitlement water. Therefore, the contractor may receive water above its Table A for the year. Interruptible water deliveries do not impact entitlement water all
3. If demand for interruptible water is greater than supply in any month, the supply allocated in proportion to the Table A entitlements of those contractors requesting interruptible water. The maximum demand assumed for interruptible water is 84 TAF month.

IX. CVP Demands, Deliveries & Deficiencies

A. 1995 level CVP demands, including canal losses but excluding wildlife refuges are as follows (see Item IXB below for refuge demands):

Contra Costa Canal	=	140 TAF/year
DMC and Exchange	=	1,561
CVP San Luis Unit	=	1,260
San Felipe Unit	=	196
Cross Valley Canal	=	128
Total CVP Delta Exports	=	3,285 TAF/year

Including wildlife refuges, total CVP demand is 3,563 TAF/year. CVP Delta export demands are reduced in certain wet years (in the San Joaquin River Basin) when "James" bypass are available in the Mendota Pool.

B. Sacramento Valley refuge demands are modeled implicitly in the hydrology through rice and duck club operations. Sacramento Valley refuges include Gray Lodge, Modoc, Sacrament Delevan, Colusa and Sutter. Level II refuge demands in the San Joaquin Valley are expressed

modeled at an assumed level of 288 TAF/year. San Joaquin refuges include Grasslands, Los Banos, Kesterson, San Luis, Mendota, Pixley, Kern and those included in the San Joaquin Basin Action Plan.

C. CVP South-of-Delta deficiencies are imposed when needed by contract priority. CVP is classified into four groups: agricultural (Ag), municipal and industrial (M&I), Exchange and Refuge. Deficiencies are imposed in accordance with the Shasta Index and sequentially according to the following rules:

1. Ag requests are reduced up to a maximum of 50 percent.
2. Ag, M&I and Exchange requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag deficiencies are 75 percent.
3. Ag, M&I and Refuge requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag and M&I deficiencies are 100 percent and Refuge is 25 percent, respectively.
4. M&I requests are reduced until cumulative deficiencies are 100 percent.
5. Further reductions are imposed equally upon Exchange and Refuge.

D. Deficiencies in the form of "dedicated" water and "acquired" water to meet 800 TAF/CVPIA demands are not imposed.

X. Delta Standards

A. Delta water quality standards are maintained at Contra Costa Canal intake (M&I), Emeryville and Jersey Point (agriculture), and Antioch, Chipps Island and Collinsville (fish & wildlife) in accordance with D-1485. A "buffer" was added to insure that the M&I standard at Contra Costa Canal is maintained on a daily basis. Thus, DWRSIM uses a value of 130 mg/L for the 150 mg/L standard and a value of 225 mg/L for the 250 mg/L standard. The following water quality objectives are not modeled:

1. the 250 mg/L M&I chloride standards at Cache Slough, Clifton Court Forebay and Tracy Pumping Plant
2. the agriculture EC standards on the Mokelumne River (at Terminous) and on the San Joaquin River (at San Andreas Landing)
3. the fish and wildlife EC standards on the San Joaquin River (at Prisoner's Point)

B. Minimum Sacramento River flow (at Rio Vista) and Delta outflow requirements (at Chi Island) are maintained in accordance with D-1485. Water year classifications are determined using the Sacramento River Index as published in DWR Bulletin 120.

C. Delta cross channel gates are closed in January through May when the Delta Outflow is greater than 12,000 cfs in accordance with D-1485. Additionally, the gates are closed one month when upstream Sacramento River flows are greater than 25,000 cfs.

D. The D-1422 San Joaquin River water quality objective at Vernalis (500 ppm TDS) is maintained by releasing water from New Melones Reservoir. A 70 TAF/year cap on reservoir releases is not imposed. If New Melones Reservoir storage drops to 80 TAF (per an April 1996 letter from USBR to SWRCB), additional water is not provided for salinity control and the water quality standard is violated.